

THE FATE AND IMPORTANCE OF FETAL LACTATE IN THE HUMAN PLACENTA - A NEW HYPOTHESIS

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Previous experimental work by BURD et al.(3), CHAR and CREASY (5) in the ewe, COMLINE and SILVER (6) in the cow have shown that in these species the placenta furnishes lactate to the fetus and that this substance can be considered as an important nutriment. BATTAGLIA et al.(2) has estimated that this nutriment contributes up to 25% of metabolic requirements of the lamb.

We have studied concentration of lactate on the maternal and fetal side of the placenta in 60 cases of elective cesarean section (iliac artery, uterine vein, umbilical artery and vein). In 34 of these cases simultaneous determination of free amino-acids has been conducted in the same blood samples.

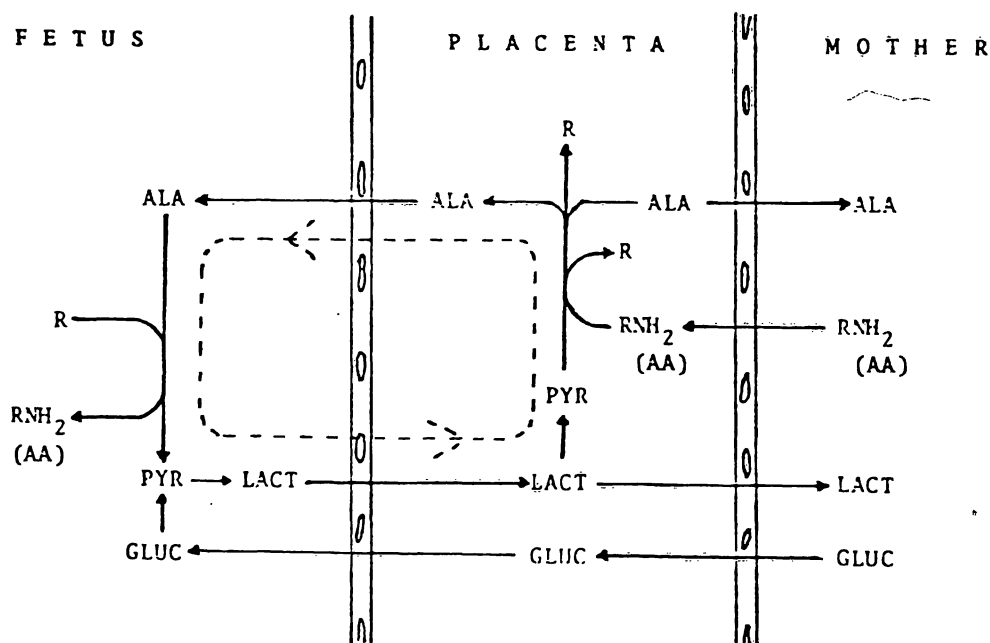
Tab.I gives the values and statistical significance of differences for lactate and alanine.

	L A C T A T E				A L A N I N E	
	PLASMA mean \pm 5	N	BLOOD mean \pm 6	N	PLASMA mean \pm 6	N
UMBILICAL ARTERY UA	2.29 \pm 1.20	60	2.01 \pm 0.77	60	0.345 \pm 0.107	31
UMBILICAL VEIN UV	2.03 \pm 0.87	59	1.81 \pm 0.57	59	0.390 \pm 0.097	30
ILIAC ARTERY IA	1.47 \pm 0.52	60	1.36 \pm 0.43	60	0.255 \pm 0.124	30
UTERINE VEIN UV	1.51 \pm 0.54	60	1.42 \pm 0.40	60	0.291 \pm 0.129	30
UA - UV	0.25 \pm 0.48	58	0.20 \pm 0.34	58	-0.049 \pm 0.054	30
Paired "t"	4.09		4.36		4.88	
Probability	<0.001		<0.001		<0.001	
IA - UV	-0.05 \pm 0.24	59	-0.06 \pm 0.20	59	-0.034 \pm 0.071	30
Paired "t"	1.59		2.66		2.75	
Probability	>0.1		<0.01		<0.02	
VALUES OF LACTATE AND ALANINE ARE EXPRESSED IN mmol·min ⁻¹ . SIGNIFICATION OF ARTERIO-VENOUS DIFFERENCES HAVE BEEN TESTED ACCORDING TO ZERO ON PAIRED VALUES.						

- Comparison of concentrations and estimated blood flow in maternal and fetal vessels lead to conclude that every minute 0.06 mmol disappears from the fetus side into the placenta. One half of this is metabolised in situ, the other half crosses over into the maternal circulation.

- At the same time the placenta elaborates alanine which goes back to both fetus (rate : $0.0075 \text{ mmol} \cdot \text{min}^{-1}$) and maternal (rate : $0.0125 \text{ mmol} \cdot \text{min}^{-1}$) circulation. Total production is thus $0.020 \text{ mmol} \cdot \text{min}^{-1}$.

The origin of this alanine production can be amination of pyruvate (Fig.1), the source of which being lactate (the amount of alanine formed is not statistically different from that of lactate which disappears : $0.020 \text{ mmol} \cdot \text{min}^{-1}$ vs/ $0.027 \text{ mmol} \cdot \text{min}^{-1}$).



In the fetus of ruminating species the placenta of which is syndesmochorial, neoglucogenesis from lactate has been shown to be active (8,9). But in other species such as rabbit, rat, guinea-pig, the placenta of which is hemochorial, the enzymes necessary for neoglucogenesis are inactive in utero (1,4,10). This might be the same in the human fetus, but has to be verified.

All these considerations lead to the thought that it is probably hazardous to compare sheep fetus with human fetus, and that studies concerning the existence

of lactate-alanine cycle might be very important for comprehension of fetal metabolism (7).

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